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(54) IMPROVEMENTS IN SOLID FUEL FIRED HEATING APPLIANCES

(71) We, GLYNWED DOMESTIC AND HEATING APPLIANCES LIMITED, a British company, of P.O. Box No. 30, Ketley, Telford, Shropshire, TF1 1BR, England, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to solid fuel fired heating appliances and is particularly concerned with draught control means for such appliances.

Solid fuel fired heating appliances comprise a combustion chamber which may be either open to a room, or substantially enclosed. In either case, there will be provided an opening generally located above or below a grate of the combustion chamber, through which a draught of air may be drawn to pass through any fuel lying on the grate. The draught, and small combustion products picked up by the passage of the draught through any burning fuel, may pass out of the combustion chamber by way of a flue. Where the heating appliance is to be used to heat domestic water, there will usually be provided a boiler part in the flue of the appliance.

Control of the burning rate of the fuel on the grate has, hitherto, been effected by manually restricting or increasing the draught of air through the combustion chamber. This may be done by restricting the opening for the draught into the combustion chamber, or by restricting the outlet for the draught into the flue or associated chimney.

More recently, and particularly in the case of solid fuel fired heating appliances incorporating a boiler, the control of the rate of burning of the fuel has been effected by a thermostat-controlled device. The thermostat may be set for a particular rate of burning of the fuel has been effected by a thermostat-controlled device. The thermosta may be set for a particular room or water temperature so that when that temperature is attained, the thermostat actuates the device which causes the draught to be restricted whereby the fuel in the combustion chamber burns less quickly and less heat is produced. Similarly, if the temperature falls below that which is desired, the thermostat registers this and causes the device to enable an increased draught to pass through the fuel.

Thermostats of a type suitable for solid fuel fired heating appliances are usually of a mechanical or hydraulic nature since these generally enable the draught to be increased or restricted gradually as the temperature being measured drops or increases. Mechanical or hydraulic modulating thermostats are preferred to those that are of an electrical nature since the latter tend to be of an on/off type which may allow a large overshoot in temperature.

A typical example of a hydraulic modulating thermostat is one which comprises a capillary containing a fluid which expands as the temperature being measured increases. A disadvantage of both mechanical and hydraulic modulating thermostats is that they are not believed to be suitable for control by a timing device.

If, therefore, the measured temperature drops below the predetermined level set by the thermostat at which a draught control means is intended to open, a draught will be allowed to pass and the fire should flare up (assuming it is alight) whether or not further immediate heating is required. More particularly, if water heated by a boiler in the solid fuel fired heating appliance is used last thing at night, the thermostat will allow a draught to pass and if the fire is alight, the water should be re-heated substantially immediately even though further hot water may not be required until the following morning. Such excessive heating

is wasteful, and it is an object of the present invention to alleviate consumption of fuel in solid fuel fired heating appliances caused by an excessive rate of burning when heat may not be required immediately.

According to the present invention there is provided a solid fuel fired heating appliance comprising a combustion chamber, draught control means for varying the amount of air passing through any fuel in the combustion chamber and biased towards either an open or a closed condition, first adjustment means comprising a non-time controlled thermostat device adapted to open or close the draught control means against the bias, and second adjustment means for the draught control means which second adjustment means is associated with a timing device and is adapted at the start of a preselected period of the day or at the start of each of two or more pre-selected periods of the day to close the draught control means.

By the present invention the rate of burning of fuel in a solid fuel fired heating appliance fitted with a non-time controlled thermostat device may be reduced even when the temperature being sensed by the thermostat device is below that at which the draught control means would otherwise be open. The second adjustment means may be actuated mechanically by the timing device to override the thermostat device, but preferably the timing device actuates it electrically. Where the second adjustment means is electrically actuated, for example if it is in the form of an electrically heatable bimetal strip device, preferably, but not essentially, said means is actuated by the electric current to act to close the draught control means.

The second adjustment means may be adapted to maintain the draught control means closed throughout the or each preselected period, which may be extensive, when heat from the heating appliance is not required immediately, for example, during the afternoon or at night. Preferably, however, the second adjustment means is adapted to maintain closed the draught control means throughout the or each period except for one or more intervals during which the draught control means is responsive to the thermostat device.

The or each such interval will be relatively short compared to the length of the period during which it occurs, but may be adjustable to any desired length, for example, in the order of one to ten minutes and preferably two or three minutes, and may occur one or more times per hour during the said period. If the second adjustment means is electrically actuated by the timing device any such interval may be allowed for by a cam or other suitable known means in the timing device adjust the current to the second adjustment means.

During the or each said interval; 1) if the temperature is below that required, the draught control means will be open; 2) if the temperature is at the required level, the second adjustment means will have no influence and the action of the thermostat device will be to maintain the draught control means closed; 3) if the temperature is below the required level at the beginning of the interval, so that the draught control means is opened, but the required temperature is attained during that interval, the action of the thermostat device will be to cause the draught control means to close.

With the heating appliance of the present invention, if there is provided a boiler, the thermostat device being responsive to the temperature of the water therein, and all the water in the boiler is used just before or while the draught control means is held closed by the second adjustment means, as for instance during the late evening, the replenishment cold water in the boiler will only be heated intermittently, until the required temperature is attained, during each relatively short interval while the draught control means is responsive to the thermostat device. Preferably, the length and frequency of the or each interval during which the second adjustment means has no influence on the position of the draught control means will be adjusted so that the required temperature will be attained only at the end of the preselected period during which the or each interval occurs if the object that is being heated, i.e. a room or water, is cold at the beginning of that period. Conveniently, there will also be provided a manual cut-out switch so that the second adjustment means may be made inoperative when not required.

In a preferred embodiment the draught control means comprises a cover which is capable of closing an air inlet and which is pivoted so that in a freely hanging condition (i.e. with only gravity biasing it) the air inlet is open, and the thermostat device comprises displaceable means which is adapted during displacement in one direction, to engage by abutment the draught control means and thereby displace the cover towards the air inlet, and the second adjustment means comprises further displaceable means which at the start of the or each preselected period engages by abutment, and is thereby adapted to close, the draught control means.

The second adjustment means will

preferably be of such a nature that it may be fitted to existing appliances without substantial difficulty, and conveniently it may consist of a bimetal strip device which is provided with an electrical heating element. When an electric current is passed through the element at a time set by the timing device, the bimetal strip bends in known manner, because of the heat generated by the element. The bending of the strip as it is heated, preferably, but not essentially causes the second adjustment means to act to close the draught control means.

Various aspects of one embodiment of an appliance in accordance with the present invention will now be described, by way of example only, with reference to the accompanying illustrative drawings, in which:—

FIGURE 1 is a part-sectional frontal elevation of part of the appliance showing draught control means;

FIGURE 2 is a partial side elevation of the embodiment shown in FIGURE 1;

FIGURE 3 is a sectional plan view of the embodiment shown in FIGURE 1, and

FIGURES 4*a* and 4*b* show front and side elevations of a bimetal strip device for use in the appliance shown in FIGURES 1 to 3.

Referring particularly to FIGURES 1, 2 and 3, the solid fuel fired heating appliance comprises a combustion chamber 1 (only one corner of which is shown), in which solid fuel may be laid to be burnt. Below the combustion chamber there is provided an ashpit 2 for any solid combustion products. Also below the combustion chamber 1, and to one side of the ashpit 2, there is provided an air inlet 3 through which air or other suitable combustible gas may pass to the combustion chamber in order to provide a draught to aid burning of the fuel.

The rate of burning of the fuel is dependent upon the amount of air or gas (hereinafter referred to as "air") passing into the combustion chamber and there is, therefore, provided a cover 4 for the air inlet 3 which is openable or closable to control the amount of air passing therethrough. The cover 4 is carried by a pendulum arm 5 which pivots about a point 6, located above the air inlet 3 and to one side of the combustion chamber 1. The cover 4 and pendulum arm 5 together comprise a draught control means 12. The pendulum arm 5 carries first and second cantilever members, 7 and 8 respectively, to the side of the pendulum arm 5 remote from the combustion chamber 1. The first cantilever member 7 carries an adjustable screw 9 which is intended to abut displaceable means comprising an arm 10 of a first adjustment means comprising a non-time controlled thermostat 11, which latter is responsive to water temperature (where the heating appliance has a boiler part) or room temperature.

The weight and positioning of the cantilever members 7 and 8 and of the cover 4 causes the pendulum arm 5 to hang with the air inlet 3 open when gravity is the only biasing factor. As the temperature measured by the thermostat increases to a required level, determined by adjustment of the thermostat 11, the cover 4 is displaced towards its closed condition and thereby causes the draught to be restricted and the fuel to burn less quickly. The cover 4 will open again when the temperature being measured drops below the required level and the arm 10 is displaced by the thermostat 11 in the opposite direction unless the cover 4 is maintained closed, as described in greater detail hereinafter, by further displaceable means comprising a bimetal strip 14 of a second adjustment means firmly abutting an adjustable screw 13 carried by cantilever member 8.

There are certain periods of the day when it is not required that the temperature being measured be increased immediately it drops below the required level and the bimetal strip 14 is therefore provided in a housing 15 to override the thermostat 11. Thus, if last thing at night, all the hot water (where there is a boiler) is used up, so that the arm 10 is displaced in the opposite direction normally permitting the cover 4 to move from the air inlet 3, but further hot water is not required until the following morning, then the bimetal strip is heated to bend and thereby close the cover 4.

The bimetal strip 14 may be fitted, in its housing 15, to existing solid fuel fired heating appliances, the housing 15 being mounted on a bracket 16 which is carried on a wall 17 of the appliance. The bimetal strip 14 carries a heating element (not shown) which, when an electrical current passes through it, causes the bimetal strip 14 to be heated and to bend in known manner to abut the adjustable screw 13 carried by cantilever member 8 of the draught control means 12. Thus, the cover 4 is either actively closed over air inlet 3 (if it was open immediately beforehand) or maintained closed by the heated strip 14. If the temperature drops below the required level, the arm 10 will be displaced away from contact with adjustable screw 9 while the bimetal strip 14 is hot.

The supply of electric current to the bimetal strip 14 is controlled by a timing device (not shown) which may be set manually to permit the supply during one or

more pre-selected periods. At the start of the or each said period, an electric current flows through the heating element to heat and thereby bend the bimetal strip 14 and continues to do so except for one or more intervals of, preferably, a few minutes as determined by the timing device. During each such predetermined interval, which will conveniently occur two or three times an hour during each preselected period, the electric current is stopped and the bimetal strip 14 cools and straightens, thereby allowing the thermostat 11 to control the rate of combustion of the fuel in the appliance.

If the temperature being measured is below that at which the thermostat is set to fully close the draught control means 12, the cover 4 will be able to open during each interval to allow a draught of air to pass through the air inlet 3 to the fuel in the combustion chamber. If, on the other hand, the temperature being measured is satisfactory, the bimetal strip 14 will retract from the adjustable screw 13 when the current is stopped, since the arm 10 will maintain the cover 4 closed over the air inlet 3.

At the beginning of one of the aforementioned predetermined intervals, the temperature may be below the required level so that both the arm 10 and bimetal strip 14 allow the draught control means to open. If, during such predetermined interval, the required temperature is attained due to the extra heat from the combustion chamber 1, the arm 10 will be displaced to close the draught control means 12. If, on the other hand, the required temperature is not attained during that particular predetermined interval, at the end of the interval the heating element on the bimetal strip 14 will be re-heated and the strip will cause the draught control means 12 to shut nevertheless.

Similarly, if the temperature drops below the required level during one of the predetermined intervals, the arm 10, which would initially have been maintaining the cover 4 closed, is displaced in the opposite direction permitting the cover 4 to open until the end of that interval when the bimetal strip 14 will again cause the cover 4 to close.

WHAT WE CLAIM IS:—

1. A solid fuel fired heating appliance comprising a combustion chamber, draught control means for varying the amount of air passing through any fuel in the combustion chamber and biased towards either an open or a closed condition, first adjustment means comprising a non-time controlled thermostat device adapted to open or close the draught control means against the bias, and second adjustment means for the draught control means which second adjustment means is associated with a timing device and is adapted at the start of a preselected period of the day or at the start of each of two or more preselected periods of the day to close the draught control means.

2. A solid fuel fired heating appliance as claimed in claim 1 in which the second adjustment means is adapted to maintain closed the draught control means throughout the or each period except for one or more intervals during which the draught control means is responsive to the thermostat device.

3. A solid fuel fired heating appliance as claimed in claim 1 or claim 2 in which the second adjustment means is electrically actuated by the timing device.

4. A solid fuel fired heating appliance as claimed in claim 3 in which the second adjustment means comprises an electrically heatable bimetal strip device.

5. A solid fuel fired heating appliance as claimed in claim 4 in which electrical heating of the bimetal strip device acts to close the draught control means.

6. A solid fuel fired heating appliance as claimed in any one of the preceding claims in which the draught control means comprises a cover which is capable of closing an air inlet and which is pivoted so that in a freely hanging condition the air inlet is open, and wherein the thermostat device comprises displaceable means which is adapted, during displacement in one direction, to engage by abutment the draught controls means and thereby displace the cover towards the air inlet, and wherein the second adjustment means comprises further displaceable means which at the start of the or each preselected period engages by abutment, and is thereby adapted to close, the draught control means.

7. A solid fuel fired heating appliance substantially as hercin described with reference to the accompanying drawings.

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1 510 706 COMPLETE SPECIFICATION
4 SHEETS

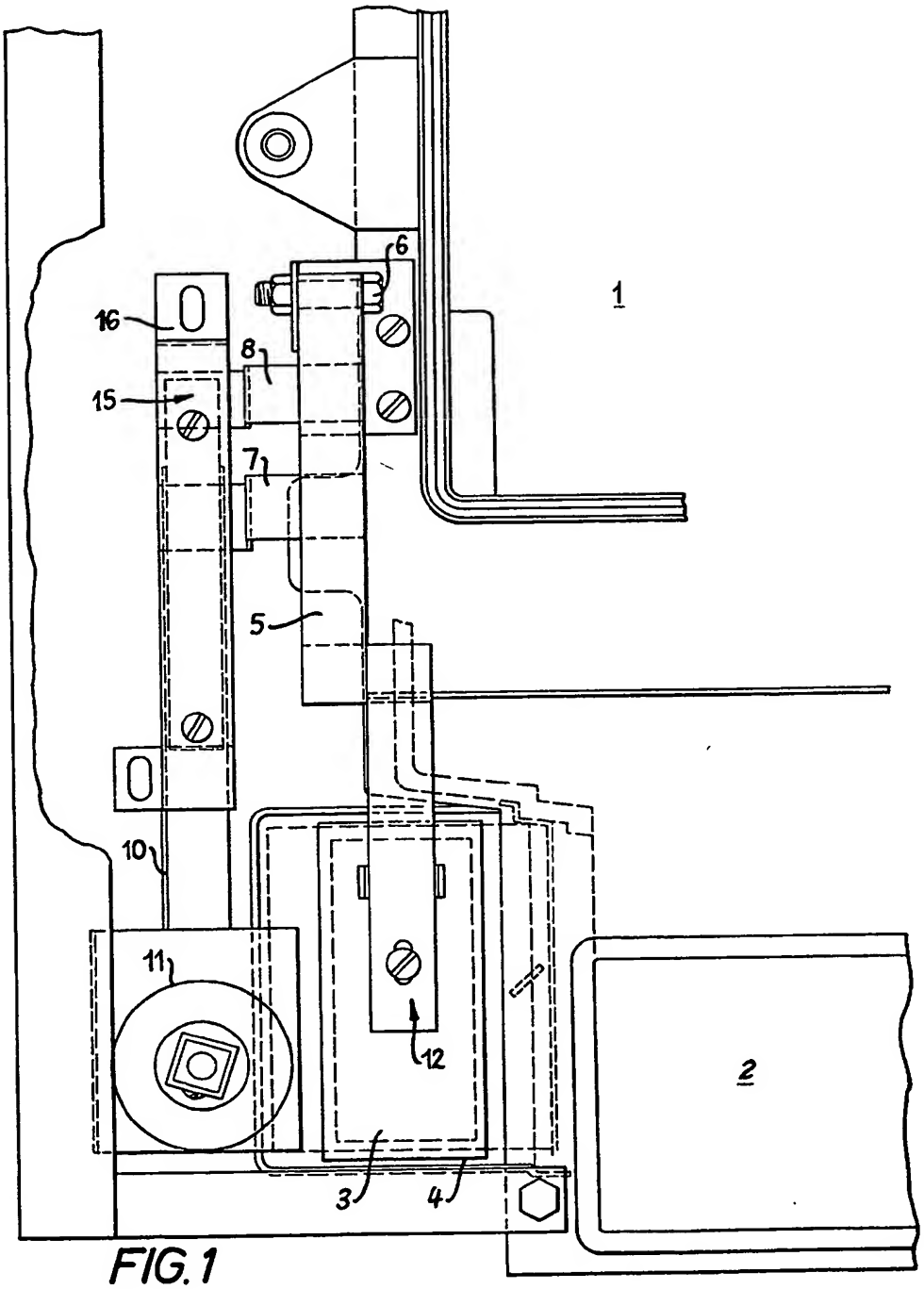

FIG. 1

1 510 706
4 SHEETS
COMPLETE SPECIFICATION
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SHEET 2

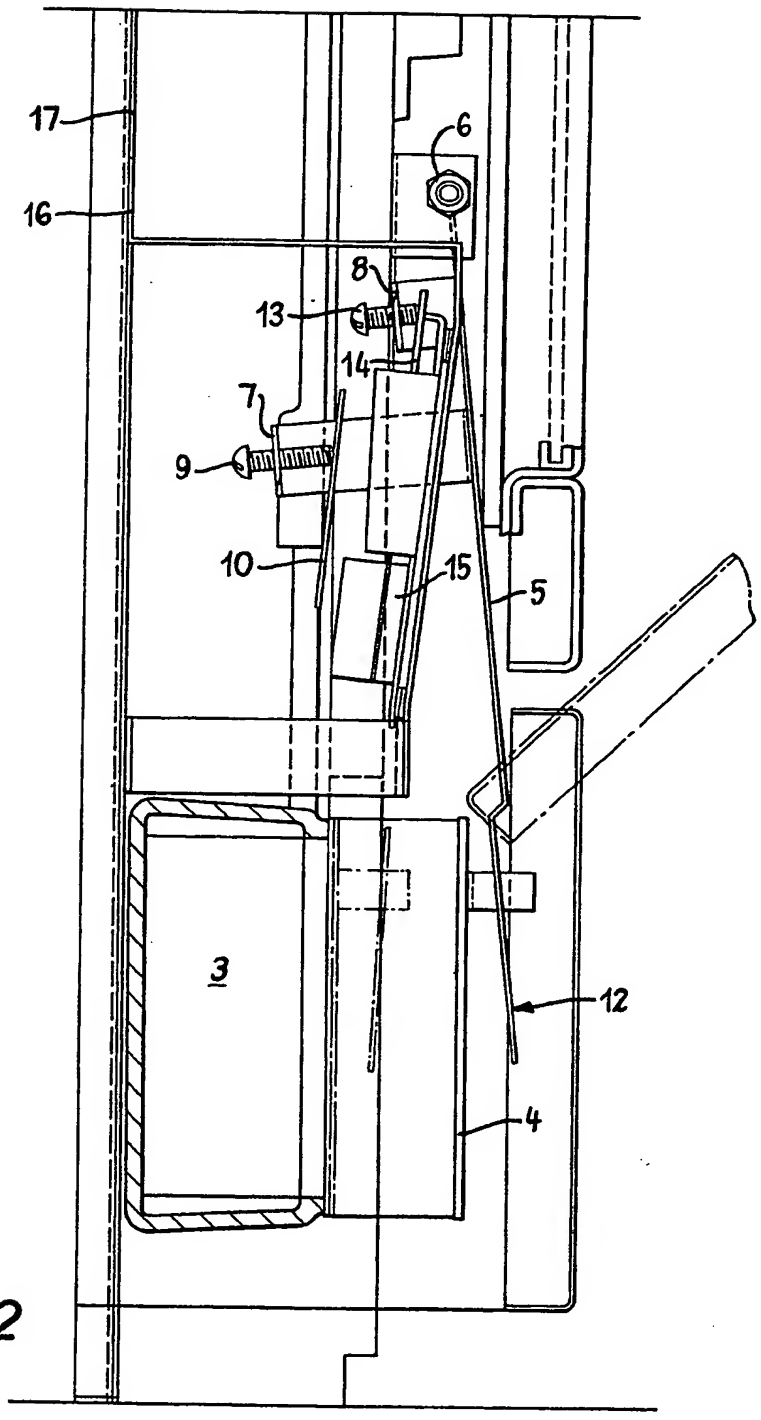

FIG.2

1 510 706 COMPLETE SPECIFICATION
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SHEET 3

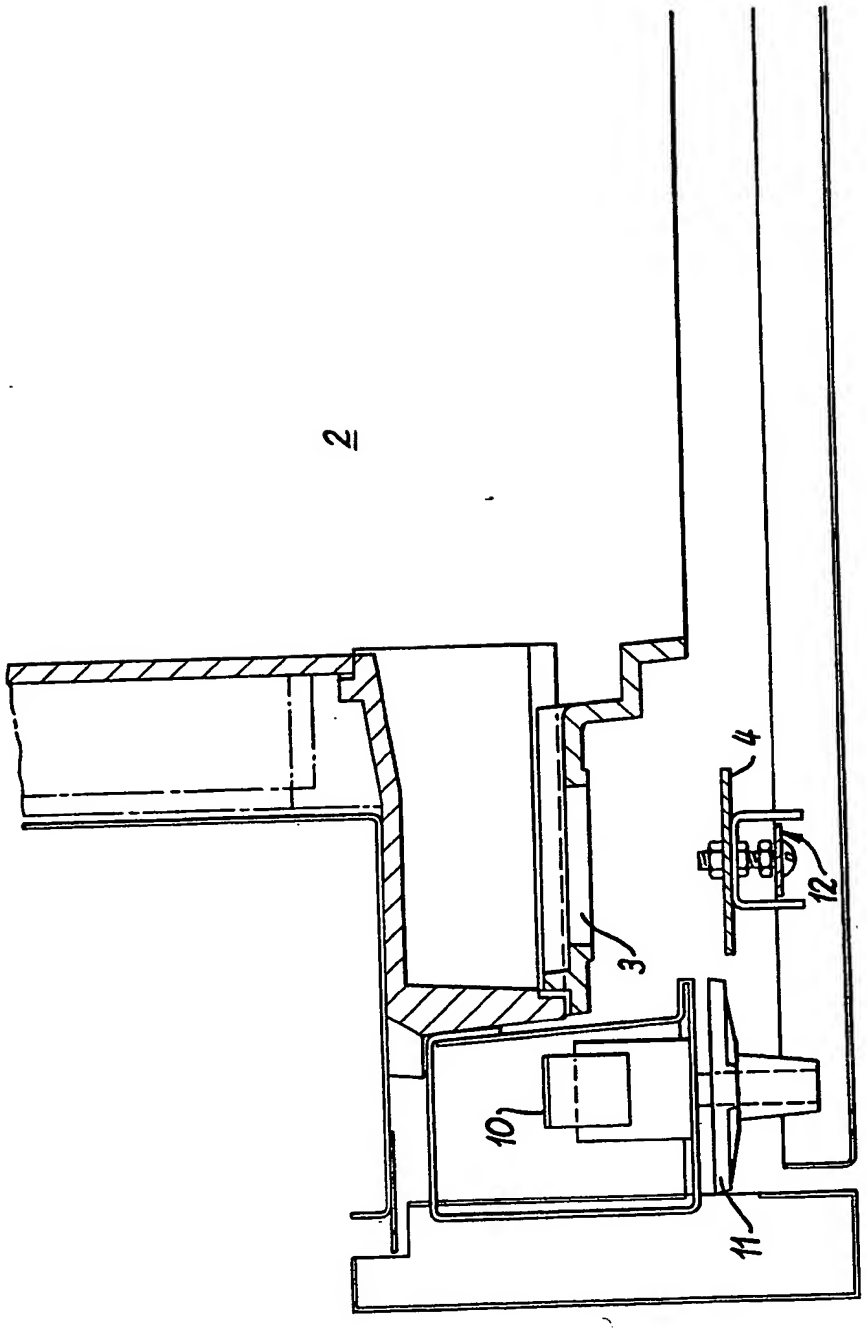

FIG.3

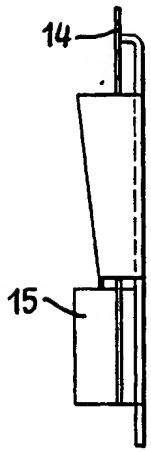

FIG.4a

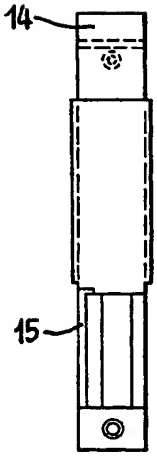

FIG.4b